

DOCUMENT RESUME

ED 393 704

SE 058 257

AUTHOR Waldrip, Bruce G.; Giddings, Geoffrey J.
TITLE Multicultural Learning Environments: Influence of Culture on Science Learning.
PUB DATE Apr 96
NOTE 12p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (69th, St. Louis, MO, April 3, 1996).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Classroom Environment; Cultural Context; *Cultural Influences; Cultural Pluralism; Foreign Countries; Multicultural Education; *Science Education; Secondary Education; *Sex Differences
IDENTIFIERS Australia

ABSTRACT

This study deals with the cultural environments of students and how cultural and contextual factors might interact with student perceptions of their learning environment and their preferred instructional modes. Data was collected from approximately 2,500 lower secondary students in Australia using the Students' Learning and Cultural Environments (SLACE) inventory that incorporates four dimensions of culture: power distance, uncertainty avoidance, individualism, and masculinity/femininity, as well as a relationship dimension that assesses the extent of interpersonal support and help between participants, a personal development dimension that assesses personal growth, and a system maintenance and system change dimension. Results reveal that students who indicated a strong congruence between the school approach to learning and their own cultural approaches saw their own preferred classroom environment as being one which is characterized by higher affiliation, involvement, teacher support, task orientation, and order/organization, compared to those who saw less connection between school and home. Other findings include: males were more likely to view classroom roles as being gender-related than female students and males were less threatened by classroom competition than female students. Contains 37 references. (JRH)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

MULTICULTURAL LEARNING ENVIRONMENTS: INFLUENCE OF CULTURE ON SCIENCE LEARNING

Bruce G. Waldrup & Geoffrey J Giddings,
Curtin University,
Australia

PERMISSION TO REPRODUCE AND
DISSEMINATE THIS MATERIAL
HAS BEEN GRANTED BY

B. Waldrup

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☐ This document has been reproduced as
received from the person or organization
originating it.

☒ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

A paper presented at the Annual Meeting of the National Association for Research in Science Teaching (NARST),
St Louis, March 30 - April 3, 1996

BEST COPY AVAILABLE

AIMS AND SIGNIFICANCE

The study reported in this paper is concerned with the cultural environments of students and how such cultural and contextual factors might interact with student perceptions of their learning environment and their preferred instructional modes.

The conceptual framework for this study evolved from two sources. First, emerging evidence from an Australian Research Council (ARC) funded project (1993-1995) entitled "The impact of self-managing schools on curriculum practice at the secondary school level" currently being completed by the researchers, suggests that students in classrooms with large numbers of students from a variety of ethnic backgrounds often find it difficult to match the knowledge and teaching strategies being used by their teachers, with those learned in their own cultures. Second, the researchers have recently completed an extensive study of science classrooms in Papua New Guinea (PNG) and a number of other Pacific countries (Waldrip, 1994; Waldrip & Giddings, 1994; Waldrip & Giddings, 1993) - in all these studies, the cultural context of the school and the subsequent teaching methods utilised by the science teacher, have revealed the powerful influence of culture on learning.

Specifically, the study set out to:

identify and examine any culturally bound learning practices of students in secondary school science classrooms;

determine how students in multicultural science classrooms perceive their learning environment; and

examine the relationships (if any) that exist between students' cultural environment and the students' expectations of the learning processes, the perceptions of their preferred learning environment, their preferred instructional strategies, and their understanding of science.

The teaching and learning strategies occurring in high school classrooms throughout multicultural Australia and the Pacific region are often perceived as being in conflict with the natural learning styles of the students (Waldrip, 1994; Sloneic & Del Vecchio, 1992). Teachers can use practices that may inadvertently conflict with a student's way of thinking, previous learning strategies, or their home environment, mores and values (Hodson, 1993). Certainly, high school classrooms around the world are becoming increasingly multicultural. Many students in our classrooms come from communities with widely differing cultural practices. There is an increasing need for teachers to be sensitive to the important cultural milieu into which their teaching and learning are to be placed (Thaman, 1993). Many teachers fail to realise that culture can be considered to be analogous to the tip of an iceberg. Some aspects of culture are highly visible but are only the visible evidence of a more fundamental, underlying, influential and persuasive set of mores, beliefs and values (Eyford, 1993).

It has been well argued that in many science classrooms, teachers attempt to enforce a traditional school view of scientific concepts while often failing to recognise the existence of their students' own preconceived views (Osborne & Freyberg, 1986; White & Gunstone, 1992). It could be argued that this occurs because:

People do not believe things that do not make sense. They believe precisely because sense is being made - because there is rationality (Cobern, 1994).

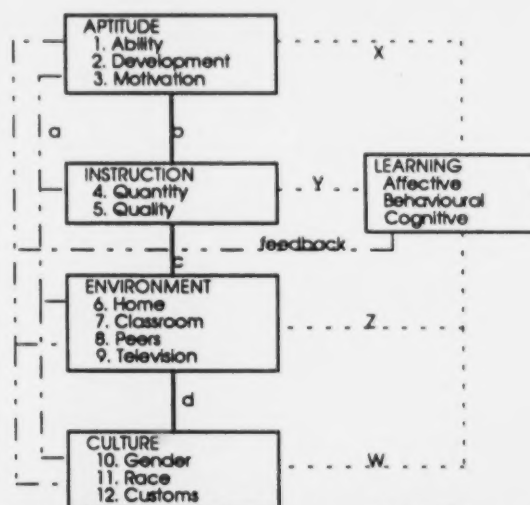
In those cases where major disparities exist between students' views and the traditional school view, it has been suggested that the students' learning becomes fragmented and lacking in cohesiveness (Waldrip & Taylor, in press). These disparities can also be exacerbated by an inappropriate selection of teaching and learning strategies (Giddings & Waldrip, 1994).

After all, real life varies enormously between different countries, between different areas of the same country, and, [...] between different social, cultural, and ethnic groups. Taking account of science as a cultural phenomenon means paying attention to all societal influences on decision making in science - not just western perceptions of science and not just western economic and social considerations (Hodson, 1993, p685).

Okebukola (1986) suggests that the cultural background of the learner can have a greater effect on education than does the substantive nature of the course content. Furthermore, it is suggested that unless students can relate the application of what is being taught to their own cultural background, then many of the teaching strategies used by teachers are likely to be less than effective in enhancing learning.

For some time now, it has been argued that one of the main sources of students' learning difficulties is the lack of optimisation between teaching strategies utilised by the teacher and the natural learning styles of the learner (Hofstein, Giddings, & Waldrup, 1994; Kempa & Martin-Diaz, 1990a & 1990b). As schools are increasingly becoming multicultural in their scope and clientele, any examination of the interaction of cultural variables with learning processes, assumes critical importance.

Walberg's (1981) model of "educational productivity" suggests that nine factors require optimisation in order to increase affective, behavioural and cognitive learning. These causal influences of student learning include a set of aptitude variables (Ability, Development & Motivation), a set of instructional variables (Quantity & Quality) and a set of environmental variables (Home, Classroom, Peers & Media). Waldrup and Giddings (1994) argued that a fourth set of variables (under the broad heading of Culture) should be included (see Figure 1). This study will build on the theoretical premise, that unless the cultural effects of educational factors are taken in context, then educational productivity will not be optimised.



Note: Aptitude, instruction, and the psychological environment are major direct causes of learning (shown as W, X, Y, and Z). They also influence one another (shown as a, b, c, and d) and are in turn influenced by feedback on the amount of learning that takes place.

Figure 1. Educational Productivity Model Within Multicultural Classrooms

Similarly, after analysing data collected in a detailed questionnaire from thousands of individuals working in multinational corporations operating in 40 countries, Hofstede (1984) meta-analysed his data and identified four dimensions of culture, namely, Power Distance, Uncertainty Avoidance, Individualism, and Masculinity/Femininity. Hofstede's work was based on studies derived from psychology, organisation sociology and management theory.

This pilot study reported here, utilises an instrument developed specifically for this study (See Table 1) that contains scales which reflect these four dimensions. Moos (1979) identified three basic types of classification for assessing human environments. In addition, Moos three types of dimensions were: a *Relationship Dimension* that assess the extent of interpersonal support and help between participants; a *Personal Development Dimension* that assess personal growth and self-enhancement; and a *System Maintenance and System Change Dimension* that measures the rule structure and its response to change. The instrument, provisionally identified as the *Students' Learning and Cultural Environments* (SLACE) inventory incorporates both the Moos classification and the Hofstede dimensions.

Scale	Description	Derived From	Sample Item
Gender Role	Measures the extent to which gender roles are differentiated or overlapped by students.	Hofstede: Masculinity/ femininity Moos: Relationship <i>Anthropology Organisation sociology</i>	I feel that all students should have the opportunity to do the same subjects
Collaboration	Measures the extent to which students are part of a strong cohesive group.	Hofstede: Individualism Moos: Relationship <i>Sociology Anthropology Management theory</i>	I try to say what the group thinks rather than give my opinions.
Risk Involvement	Measures the extent to which students feel threatened by involvement in class discussion.	Hofstede: Uncertainty Avoidance Moos: Relationship <i>Organisation sociology</i>	I prefer to allow others to answer questions in class.
Competition	Measures the extent to which the students feel threatened by competition from other students	Hofstede: Uncertainty Avoidance Moos: Personal development <i>Organisation sociology Anthropology</i>	I don't care if I get a poor mark in class .
Teacher Authority	Measures the extent to which students expect and accept that power is distributed unequally in a school.	Hofstede: Power Distance Moos: Personal development <i>Social psychology Management theory</i>	I must not question what teachers tell me in class.
Modelling	Measures the extent to which the students prefer to learn by a process of modelling.	Hofstede: Uncertainty Avoidance Moos: Personal development <i>Organisation sociology</i>	I learn best by memorising.
Congruence	Measures the extent to which the students feel threatened by learning in ways that are different to their own cultural pattern.	Hofstede: Uncertainty Avoidance Moos: System maintenance & change dimension <i>Organisation sociology</i>	What my parents tell me makes more sense to me than what I learn in class.
Knowledge Transmission	Measures the extent to which students feel threatened by becoming involved in new learning process.	Hofstede: Uncertainty Avoidance Moos: System maintenance & change dimension <i>Organisation sociology</i>	I like to learn the way I have always learnt things

Table 1. Descriptive Information for Each Scale in the SLACE Instrument

The initial development of SLACE was guided by:

- i. Consistency with the social psychology, organisation sociology and anthropological literature. All relevant scales contained in existing instruments for learning were examined for guidance in identifying dimensions.
- ii. Consistency with management theory literature. Important dimensions in the unique environment of multicultural, multi-national organisations were identified through an extensive review of the literature.
- iii. Coverage of Moos' General Categories. Dimensions for the SLACE were chosen to include at least one scale from each of the Moos' three general dimensions.
- iv. Salience to teachers and students. By interviewing teachers and students an attempt was made to ensure that the SLACE's dimensions and individual items were considered salient by teachers and students.
- v. Economy. SLACE was designed to have a relatively small number of reliable scales, each containing a small number of items.

While there are a number of research studies in science education in existence concerning culture and education generally (Atwater, 1993; Cobern, in press; Maddock, 1981; Tobin, 1993) comparatively little research examines the interaction that occurs between students' cultural environment and their learning processes. It was considered timely and relevant to examine how students' cultural expectations and motivational traits enhance or inhibit their learning within a secondary school science classroom within the Pacific region. As classes within the region are becoming increasingly multicultural, this study is particularly important as it will examine for the first time in an Australian and South Pacific setting, the crucial interaction of cultural background, students' perceptions of their learning environment, their preferred learning strategies and their understanding of science.

RESEARCH PLAN, METHODS AND TECHNIQUES

The study is relatively unusual in the field of classroom environment research because it combines both quantitative and qualitative methods. A large sample of lower secondary school students is involved in the quantitative aspects of the study in order to generate dependable validation data and permit statistical analysis. Because of the intensive nature of the qualitative component of the study, a smaller subsample of classes (10%) has been chosen. The study consisted of three distinct phases.

Sample

The first phase involved the identification and development of instruments designed to measure: aspects of a student's cultural expectations and environment (the SLACE for which preliminary development work has been underway for the past two years); perceptions of classroom environment (utilising a classroom environment measure based on the Classroom Environment Scale [CES]); a previously validated tests based on the Test of Enquiry Skills [TOES] and the Test Of Science Related Attitudes [TOSRA] (Fraser, 1979, Fraser, 1981). In order to validate the instruments, field testing in a pilot study was carried out across a sample of 500 Year 8/9 students from secondary schools drawn from school districts in Western Australia, Melanesia and Polynesia.

Following the pilot study, the second phase of the project will involve the instruments being administered to a comprehensive sample of science students across three Australian states. The total sample will involve approximately 2500 students from 100 science classes at the lower secondary school level (spread approximately equally between Years 8 and 9, each in a different school. These systems have been chosen to reflect differences in the ethnic mix of their multicultural classrooms.

The large database consisting of the responses from 100 classes will be used in validating the SLACE and providing additional validation data for the CES, the TOES and the TOSRA. Validity will be reported in

terms of reliability, scale independence, factor structure and ability to differentiate between the perceptions of students in different classrooms. As recommended by Sirotnik (1980), all validation statistics will be reported separately using the individual student score and the class mean score as the unit of analysis. The third phase will involve a closer case study of three representative schools in each state.

The quantitative and qualitative information identified in this pilot study is currently being used in refining the questionnaires and in seeking explanations to patterns identified through the statistical analysis of the quantitative information (e.g. why students from different cultural backgrounds differ in their perceptions of learning environment; how students' preferred learning strategies affects student outcomes; how differing cultural expectations relate to students' understanding of science, etc).

OUTCOMES

Students who indicated a strong congruence between the school approach to learning and their own cultural approaches, saw their preferred classroom environment as being one which is characterised by higher affiliation, involvement, teacher support, task orientation, and order/organisation, compared to those who saw less connection between school and home. If students find that the manner in which things are learned at home clashes with their school-based learning experiences, it is not unreasonable to suggest that they find school a somewhat confusing experience. That is, they perceive their environment less favourably.

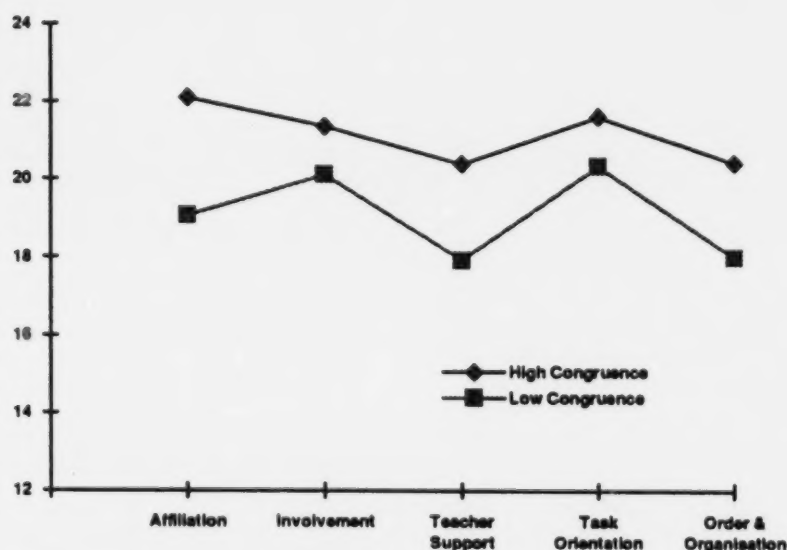


Figure 1. Congruence Between Home and School Learning and Students' Preferred Classroom Environment

Figure 2 indicates that students who revealed that they had a high respect for authority (and authority figures) saw their preferred classroom environment as being one which is characterised by higher affiliation, teacher support, and order/organisation, compared to those who had a lower respect for authority. In particular, these students preferred a much higher level of order and organisation.

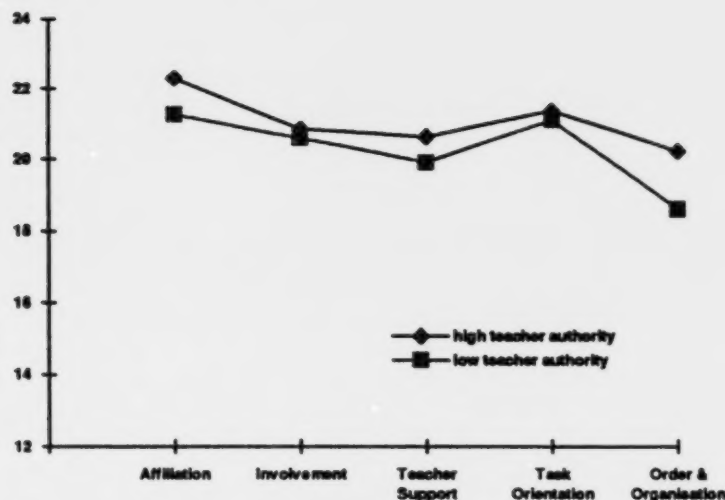


Figure 2. Respect for Authority and Students' Preferred Classroom Environments

Students who revealed that they were not particularly threatened by classroom competition saw their preferred classroom environment as one which is clearly characterised by higher affiliation, involvement, teacher support, task orientation and order/organisation (see Figure 3). Thus students who were not threatened by competition tended to react positively to closer ties with fellow students, viewed teacher support as being positive and non-threatening, and were much more likely to become involved in various forms of classroom interaction.

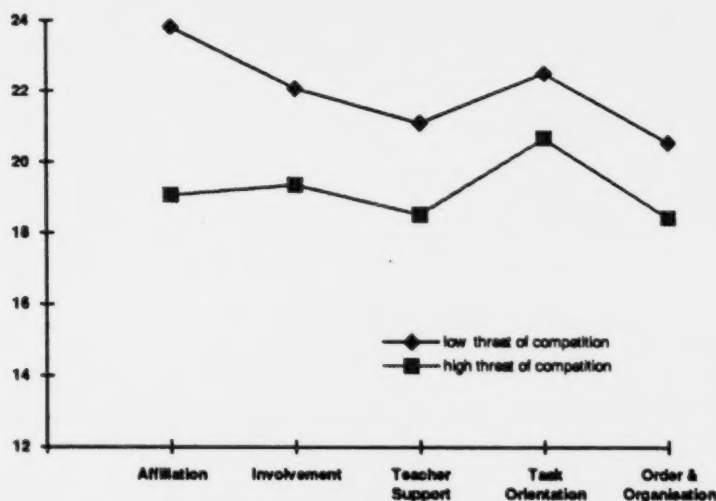


Figure 3. Threat of Competition and Students' Preferred Classroom Environment

Students who revealed through the culture questionnaire that they viewed many classroom roles as being gender-related, saw their preferred classroom environment as one which is characterised by higher affiliation, task orientation, and order/organisation (see Figure 4). Thus those who saw teachers and students with distinct gender roles in the classroom tended to seek a classroom environment that was highly ordered, organised, and on-task.

BEST COPY AVAILABLE

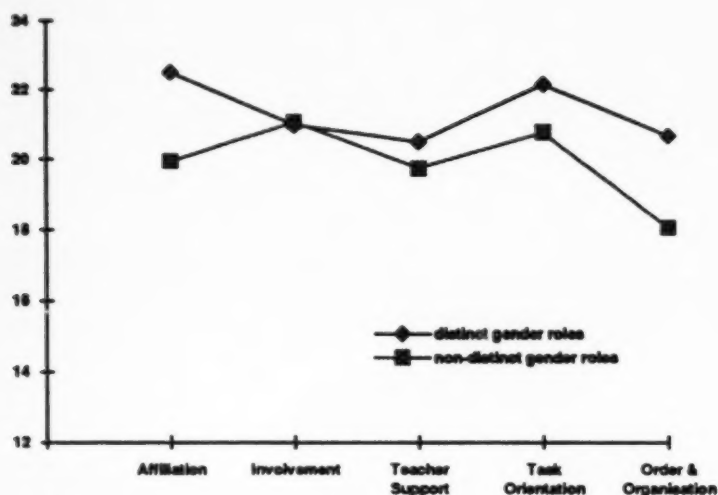


Figure 4. Gender Differentiation and Students' Preferred Classroom Environment

As in past learning environment research, male students consistently perceived their learning environment more favourably than did their female counterparts (see Figure 5).

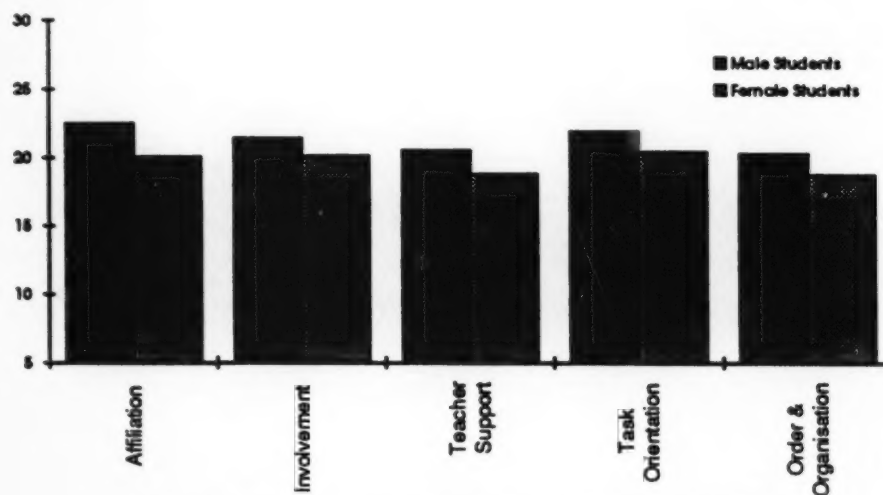


Figure 5. Gender and Students' Preferred Classroom Environment

Figure 6 tells us that male students were more likely to view classroom roles as being gender-related than female students.

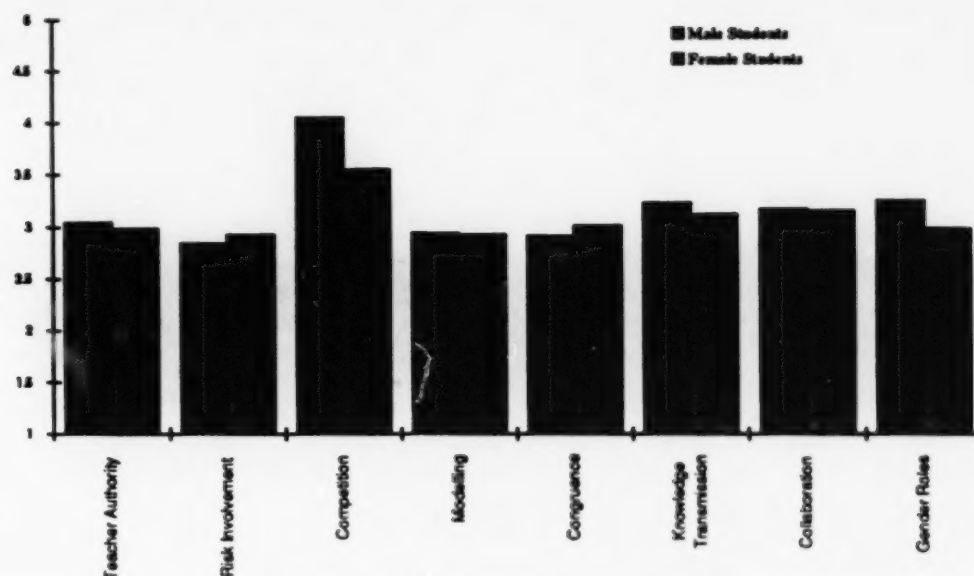


Figure 6. Gender Related to Scales on the SLACE

Similarly males were less threatened by classroom competition than the female students. In many cultures the males are brought up in a competitive environment and one would expect the males to be more used to competition than their female counterparts.

Presently, there is no clear-cut answer to the question as to how we can translate the results of such research into practicable teaching strategies which are sensitive to the great diversity of the cultural expectation and preferred learning environments of students. However, the underlying premise of this research is that if we can identify the cultural expectations of multicultural students in a given classroom then it follows that we have an opportunity to optimise the teaching strategies to be utilised with them (Hodson, 1993).

Recognition of the existence preferred learning styles leads to a notion of extending choice of learning method to the learner. The introduction of a modular approach to course organization opens up the possibility of extending choice of content to the learner (Hodson, 1993, p695).

Teachers can utilize this new information to better match the teaching strategies they select for that class with the cultural expectations of their students. In practice, this would mean that the teacher, acting in the role of a school-based manager of learning, can select a balanced set of strategies and instructional approaches appropriate to the profile that has been determined by the teacher.

REFERENCES

- Atwater, M. (1993). Multicultural science education: Assumptions and alternative views. *The Science Teacher*, 60(3), 32-38.
- Cobern, W.W. (in press). Constructivism and non-western science education research. *International Journal of Science Education*.
- Erickson, F. (1986). Qualitative methods in research on teaching. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed.). New York: Macmillan.
- Eyford, H. (1993). Relevant education: The cultural dimension. *Papua New Guinea Journal of Education*, 29(1), 1-20.

- Fisher, D.L. and Fraser, B.J. (1983). A comparison of actual and preferred classroom environments as perceived by science teachers and students. *Journal of Research in Science Teaching*, 20(1), 55-61.
- Fraser, B. (1979). *Test of Enquiry Skills*. Melbourne: Australian Council for Educational Research.
- Fraser, B.J. (1981). *Test of Science-Related Attitudes*. Melbourne: Australian Council for Educational Research.
- Fraser, B.J. (1989). Twenty years of classroom climate work: Progress and prospect. *Journal of Curriculum Studies*, 21(4), 307-327.
- Fraser, B.J. and Fisher, D.L. (1982). Predicting students' outcomes from their perceptions of classroom psychological environment. *American Educational Research Journal*, 19(4), 498-518.
- Giddings, G.J., and Fraser, B.J. (1989, June). *Development of an instrument for assessing the psychosocial environment of science laboratory classes*. A paper presented at Annual Conference of Australian Science Education Research Association, Melbourne.
- Giddings, G.J., and Fraser, B.J. (1990, April). *Cross-national development, validation and use of an instrument for assessing the environment of science laboratory classes*. A Paper presented at the Annual Meeting of the American Educational Research Association, Boston, MA.
- Giddings, G.J., Fraser, B.J., and McRobbie, C.J. (1992, April). *The evolution and use of personal forms of learning environment instruments*. A paper presented at the annual meeting of American Educational Research Association, San Francisco, CA.
- Goldstein, H. (1987). *Multi-level models in educational and social research*. London: Charles Griffin.
- Hodson, D. (1993). In search of a rationale for multicultural science education. *Science Education*, 77(6), 685-711.
- Hofstede, G. (1984). *Culture's Consequences*. Newbury Park, CA: Sage Publications.
- Hofstein, A., Giddings, G.J. and Waldrip, B.G. (March 1994). *Relationship between students' motivational patterns and instructional strategies used in science teaching*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Anaheim.
- Kay, S. (1975). Curriculum innovations and traditional culture: A case history of Kenya. *Comparative Education*, 11(3), 183-191.
- Kempa, R.F. and Martin-Diaz, M. (1990a). Motivating traits and preferences for different instructional modes in science (I). *International Journal of Science Education*, 12(2), 195-203.
- Kempa, R.F. and Martin-Diaz, M. (1990b). Motivating traits and preferences for different instructional modes in science (II). *International Journal of Science Education*, 12(2), 205-216.
- Maddock, M.N. (1981). Science education: an Anthropological viewpoint. *Studies in Science Education*, 8, 1-26.
- Moos, R.H. (1979). *Evaluating educational environments: procedures, measures, findings and policy implications*. San Francisco: Jossey-Bass.
- Okebukola, P.A. (1986). The problem of large classes in science: An experiment in co-operative learning. *European Journal of Science Education*, 8(1), 73-77.
- Osborne, R., and Freyberg, P. (1986). *Learning in science*. Heinemann Publishers, Auckland, New Zealand.
- Penick, J.E., Shymansky, J.A., Filkins, K.M. and Kyle, W.C. (1976). *Science laboratory interaction category (SLIC) - student*. Iowa City, Science Education Centre.
- Raudenbush, S. & Bryk, A. (1986). Quantitative models for estimating teacher and school effectiveness. In R. Bock (Ed.), *Multilevel analysis of educational data*. San Diego: Academic Press.
- Sloniec, E., and Del Vecchio, R. (1992). *Supportive school environments: report of research project: cross cultural tensions and students interactions in school*. Adelaide: South Australian Department of Education.
- Sirotnik, K. (1980). Psychometric implications of the unit-of-analysis problem (with examples from the measurement of organizational climate). *Journal of Educational Measurement*, 17, 245-282.
- Thaman, K.H. (1993). Culture and the Curriculum in the South Pacific. *Comparative Education*, 29(3), 249-260.
- Tobin, K. (1993). Research on learning and teaching science in challenging, culturally diverse settings. *Narst News*, 35(4), 1-2.
- Tobin, K., Kahle, J. & Fraser, B. (Eds.). (1990). *Windows into science classrooms: Problems associated with higher-level cognitive learning*. London: Falmer Press.
- Walberg, H.J. (1981). A psychological theory of educational productivity. In F.H. Farley and N. Gordon (eds). *Psychology and education*. Berkeley, Calif: McCutchan.
- Waldrip, B.G. (1994). *A Study of Achievement, Attitudes, Teaching Practices and Learning Environments in Secondary School Science Laboratory Classes in Papua New Guinea*. Phd Thesis, Curtin University.*
- Waldrip, B. and Giddings, G.J. (April 1993) *Teacher's classroom practices science laboratory learning environment and students' attitudes in South Pacific secondary schools*. Paper presented at the Annual Meeting of the American Educational Research Association, Atlanta.

- Waldrip, B.G. and Giddings, G.J. (1994, April). *Educational productivity, Culture and Pedaogy*. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, New Orleans.
- Waldrip, B.G. and Taylor, P.C. (in press). Permeability of students' world views to their school views. . *Journal of Research in Science Teaching*.
- White, R. and Gunstone, R. (1992). *Probing Understanding*. London: Falmer Press.
- Zaharlick, A. (1992). Ethnography in anthropology and its value for education, *Theory Into Practice*, 31(2), 116-125.